BY DIANA VOS
PROJECT WILD COORDINATOR

REPRODUCTION

Fish facts of life

Fish breeding behavior & development

UNDERWATER, the facts of life are not about the birds and the bees. But for Utah's diverse fish species, breeding—called spawning—is just as important, and interesting to learn about, as wildlife breeding on land.

Spring fever

Fish become aware of spring's arrival by the changing angle of the sun and increased day length spring brings. This changing length of day, called *photoperiod,* causes changes in hormone levels that signal to most fish that it's time to spawn.

The age at which different fishes reach sexual maturity varies. In most cases, the shorter a species' lifespan, the earlier it reaches sexual maturity. Salmon require two to five years to reach maturity, and after spawning they die. Species such as bass and trout usually spawn every year once they are mature whereas some eels may only spawn once every 10 to 12 years.

Each species of fish prefers a specific kind of habitat for spawning. Many fish migrate to spawning areas prior to spawning because habitat suitable for spawning and development of young is usually different from the habitat where a fish feeds. Movements for spawning are commonly triggered by changes in temperature, since temperature is an important factor in egg survival.

Some fish, such as bass, travel only a small distance to find a spawning bed. Trout travel farther, leaving their feeding territory to swim upstream to a stream's headwaters. Salmon are among the longest-distance travelers, swimming hundreds of miles upstream from the ocean to the spot where they were born.

Fish such as salmon that migrate from a saline ocean environment into freshwater rivers to spawn, are termed *anadromous.* In contrast, fish such as eel, which migrate from fresh water lakes and rivers to the ocean to breed, are called *catadromous.*

Finding a mate and spawning

Prior to spawning, some species undergo changes that make the sexes

Kokanee salmon turn from silver to orange to deep red prior to spawning.

An aquatics biologist strips eggs from a female trout.

look different. For example, male salmon and trout commonly develop a noticeable hook with strong teeth on the lower jaw called a *kype.* They also become more intensely colored. Male salmon also may develop a dorsal hump. Some male minnows and suckers grow horny breeding tubercles that help them drive off other males. Females of many fish species grow much larger than males.

Chemical signals, or *pheromones,* also can help males and females find each other. Once they find each other, some fish gather in large schools while others gather in smaller groups. In some species, females may spawn with several males or vice versa, and in others, males and females pair off.

There are three main methods of spawning. In most species, the female simply releases her eggs into the water to be immediately fertilized by sperm, called *milt,* released from the male. This type of fertilization is called *external fertilization.* In some fish, fertilization occurs within the body of the female before she drops her eggs into the water, which is called *internal fertilization.* Specialized fins help transfer the milt into the oviduct of the female. Lastly, some female fish retain fertilized eggs inside their bodies and later give birth to live young.

Protecting the eggs

Some fish scatter their eggs over the bottom, others attach them to aquatic plants, while still others let them drift in the water. For example, when suckers spawn, groups of males gather on a gravel riffle and wait for females to enter from a pool downstream. As the female enters the group of males, the fish rapidly spawn and the fertilized eggs are randomly dispersed. With little protection for the eggs, such species usually lay many eggs to balance out the numbers lost to predation and other hazards.

Other fish species, such as salmon and trout, make an attempt to hide their eggs. Using their powerful tails, females dig out a depression (called a *redd*) along the bottom of a gravel streambed and deposit their eggs in the depression. After the eggs are fertilized, they are covered with gravel and left to develop on their own. In some species, males defend the redds from other males.

Many fish protect their eggs and young after spawning. These fish typically produce fewer eggs than fish that scatter or hide their eggs because the care they give their young leads to higher survival rates. Unlike most land animals, the male of such fish species most often devotes his time to protecting the young. The males may practice elaborate courtship rituals to lure females to the spawning site they've selected. After spawning, not only do the males guard the eggs and young against predators, they also keep the eggs free of debris and fan them to keep a current of oxygen-rich water flowing over them.

Some males guard their eggs and young by carrying them around after spawning. Most of the fish that protect their eggs and young, however, build nests near vegetation, rocks or logs to shelter the eggs and young. The most common "nest builders" in North America are members of sunfish and black bass families. These fish often nest in large colonies. Dur-

ing breeding, female bluegills swim through the nesting area to scope out the males and their nest sites. Female bluegills seem to prefer spawning with the males that put on the most impressive display, have the strongest color patterns and own the best nest sites. Some smaller males hang out on the fringes of the nesting colony, sneaking in to deposit some of their own milt when spawning takes place. Other small males gain access to the nesting colony by adopting similar color patterns to the females, which tricks the males into thinking the small males are females.

Male bass build their nest in a shallow, rocky area that is warmed by the direct rays of the sun for most of the day. They then coax females to the nest to lay their eggs. After a brief day or two of spawning, the male guards his nest with great vigor, ramming his snout into any intruders to drive them away.

Other fish, including sculpins, darters, minnows and catfish, build nests that are hidden in caves, cavities and burrows, or beneath rocks or logs.

The eggs develop

After fertilization and contact with water, the eggs harden and cell division begins the formation of the embryo. The embryo first develops eyespots and organs and eventually a tail. When the egg hatches, the tail of the embryo breaks out of the shell first and the embryo becomes a free-swimming larva. How long it takes an embryo to become a larva varies between species and also depends on water temperature (the warmer the water is, the faster the embryo develops). Trout eggs often take two to three months or even longer to hatch.

The developing larva (or *alevin*) gets nourishment from a yolk sac attached to it. Again, how long the yolk sac lasts as a food source depends on the species and water temperature. Once the yolk sac is depleted, the tiny *fry,* as it is now called, must feed on its own. Young fish are considered juveniles until they reach sexual maturity and begin spawning.

Large fish, long life

How long different fish live is not well known but, in general, larger fish species tend to live longer than smaller species. Most fish probably do not live longer that 10 to 15 years and many, such as killifishes and certain minnows, may live less than a year. Others, such as whale sharks, sturgeons, groupers and carp, can live a century or more.

Biologists can determine the age of bony fishes by examining a fish's vertebrae, certain bones, scales and otoliths (also called earstones, these are small, flat, oval bones found inside the heads of bony fishes).

The contents of these jars show early stages of fish development—from left to right, fish eggs, sac fry and fry.

As fish grow, their bones and scales form thin visible layers called *circuli.* Similar to the growth ring of a tree, when growth is faster the circuli are widely separated, forming a light band. During the winter, when water temperatures are cooler and fish feed less, growth is slower and the circuli are crowded closer together, forming a darker band. A pair of bands—one light and one dark—forms an annulus, which indicates a year of growth. For most fish with scales, a biologist can remove a scale and count the growth rings. Spines, otoliths or vertebrae are used to determine age in fish without scales. Fish have to be killed to read otoliths or vertebrae. Tagging studies also are useful for learning about age and growth in fish. If captured again, tagged fish can be weighed and measured to learn how much they've grown since the last time they were examined.

Next time you catch or see a fish in one of Utah's lakes or streams, it can be fun to think about its life and how it came to be.

Free resources, activities, literature connections and a list of Web sites for educators and youth related to this article can be viewed online at *wildlife.utah.gov/projectwild/magazine.* If you are unable to access the Internet, contact Project WILD at (801) 538-4719 or e-mail *dianavos@utah.gov* to obtain the information.

Getting WILD! Utah's WILD Notebook is produced by Utah's Project WILD program. WILD workshops, offered by the Utah Division of Wildlife Resources, provide teachers and other educators with opportunities for professional development and a wealth of wildlife education activities and materials for helping students learn about wildlife and its conservation. For a current listing of Project WILD educator workshops, visit the Project WILD Web site at *wildlife.utah.gov/projectwild* or e-mail *DianaVos@utah.gov*.

Educator resources

The following resources for teachers are available on request by contacting Project WILD at (801) 538-4719:

Utah Fish Characteristics—General information, physical features, habitat, feeding behavior and spawning behavior of selected Utah fish species.

Kokanee Salmon Poster—Colorful and educational poster featuring the life cycle of the fascinating Kokanee salmon.

Kokanee Salmon, Wildlife Notebook Series #10—Informative four-page wildlife fact sheet discussing life history and management of this species.

A Fish Riddle—Activity sheet for students to practice aging a fish by examining the growth rings on a fish's scale.

Life cycle of a fish diagram

List of UDWR Aquatic Education Teacher Resources—"Fishing Box" that is available for loan by teachers includes samples of fish eggs, larvae and fry.

Books for learning more

A Fish Hatches by Joanna Cole, Morrow, 1978.

Fish: An Enthusiast's Guide by Peter B. Moyle, Univ. of California Press, 1993.

Fishes of the Great Basin: A Natural History by William F. Sigler and John W. Sigler, Univ. of Nevada Press, 1987.

Discovering Salmon: A Nature Activity Book by Nancy Field and Sally Machlis, Dog-Eared Publications, 1996.

Biologists harvesting smallmouth bass fry from an artificial nest box.